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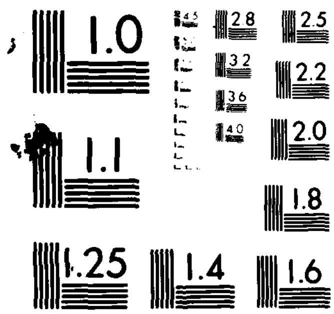

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"RYTERSKI" AND "RYMANOWSKI" WINDS

by

Janina Lewinska

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"RYTERSKI" AND "RYMANOWSKI" WINDS

Janina Lewinska

Winds, as one of the weather-forming factors, undoubtedly exert a profound effect on the formation of weather in valleys. The present work deals with description of winds blowing in the valleys of the Poprad River on the Stary Sacz, the Leluchow section and the Tabor River. Periodic winds appear along the axis of these valleys which is close to the S-N direction. Because of their force, frequency and effect on local living conditions, these winds are known to the inhabitants of these valleys under the local names of ryterski and rymanowski. For the study of these winds, I utilized results of meteorological observations obtained at the stations in Stary Sacz and Rymanow-Zdroj and for comparative purposes also at the Nowy Sacz and Kasprowy Wierch stations in 1954-55. Because of the short time from the data input, the obtained conclusions in this work should be considered as of orientation type only, particularly those of a quantitative character.

The first of the mentioned valleys (Poprad River) on the S-N axis in the Piwniczna--Stary Sacz section is located in Beskid Sadecki and cuts the massive Carpathians in the area of Leluchow. The second valley (Tabor River) also lies on an axis close to S-N, and is located in Beskid Niski. The sizes of these two valleys are not really comparable (the length of Poprad Valley in Polish territory is about 55 km, and the Tabor Valley merely 27 km); nevertheless, anemometric conditions reigning in these valleys are of similar character. When treating the material, I observed the following rules: winds from octants SE to SW with velocities 5 m and above were considered, and in more detailed treatment, winds with velocities 10 m/sec and above were considered if they were observed at least once during the day. By following this rule, I could use the criterium adopted by Gelles [11]. Moreover, when treating materials, I took into consideration the air temperature, humidity at 13:00 hr, and atmospheric pressure. At the same time, I also paid attention to the synoptic

situation on the basis of the map of Europe at 00 hr GCT. A situation which could cause air advection from the south (with particular interest in a situation which could lead to strong winds from the south direction). Preliminary analysis of the material led us to assume that the ryterski and rymanowski winds are winds of foehn type (known in Tatras as halny).

The values of air temperature and atmospheric pressure (monthly averages) and their average daily values the highest (or lowest) during the wind duration, and differences between these values, are presented in Tables 1 and 2. In all the observed cases, one can notice a very distinct temperature rise as well as fall of pressure, as compared to air covering the valley in the period preceding the southern wind. We have not included the data on the loss of humidity because of considerable gaps in observational material; nevertheless, even here one can see considerable losses of humidity (reaching 35%). Already on the basis of these data we can assume that we are dealing with falling winds, causing clear thermo-hygro-baric effects both in the Poprad Valley and in the Tabor Valley.

The frequency of appearance of winds from the southern quadrant at the above mentioned stations is shown graphically in Figures 1 and 2 (the fact that in specific cases we included in the graphs winds with velocity on orographic form, hence in the narrow valley these velocities will be usually much higher than, for instance, in the broad and flat Sadecki Valley). In agreement with generally accepted views, we assumed that winds of foehn type appear here when there are centers of low pressure north of the Carpathian chain and centers of high pressure south of it. Examples of such weather conditions are provided by situations shown on synoptic maps on May 18, 1955 (Figure 3) and on January 31, 1955 (Figure 4). In those cases, centers of low pressure were moving from the Atlantic to the area of Great Britain and the North Sea, and centers of high pressure--from the Mediterranean Sea to the Black Sea area, Ukraine and Asia Minor. Such situations lead to strong winds of foehn type in the Carpathians. The isobars on synoptic maps run from SW to NE. Low baric centers moving along the Atlantic axis near Great Britain cause a drop of pressure over the

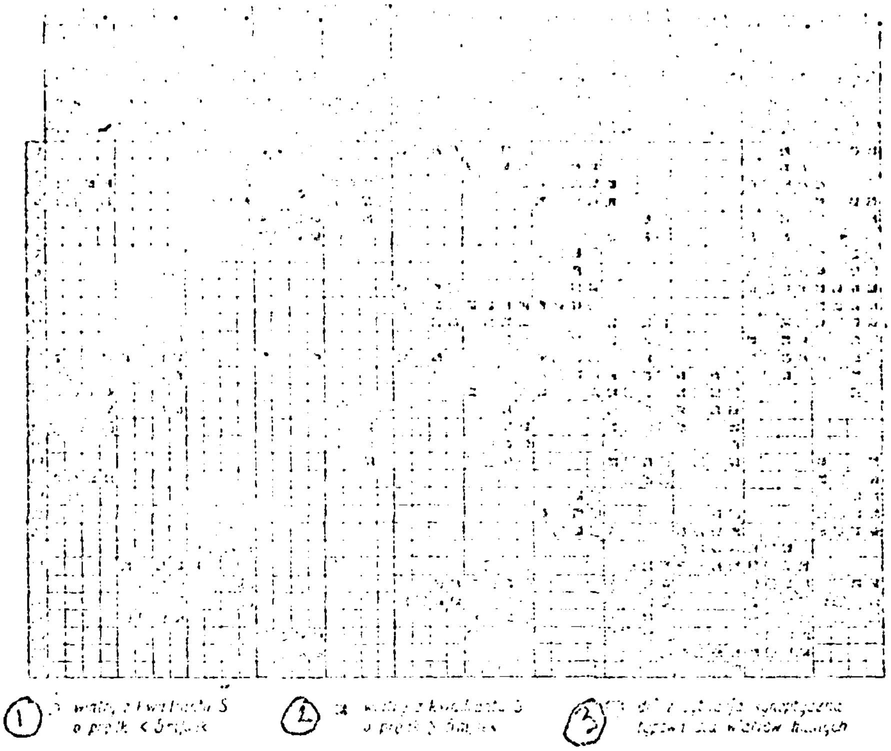

Figure 1

Key: 1--winds from S quadrant with velocities < 5 m/sec
2--winds from S quadrant with velocities ≥ 5 m/sec
3--days with synoptic situations typical for halny winds

Carpathians which, in turn, results in southern gradient winds.

Comparing baric situations with results of meteorological observations at the above mentioned stations, we arrive at the following conclusions (compare Figures 1 and 2):

1) winds from the S quadrant appear simultaneously at meteorological stations Kasprowy Wierch, Nowy Sacz, Rymanow and Starcy Sacz, hence at stations located in different orographic conditions;

2) this appearance of winds from the S quadrant simultaneously in situations described above takes place in 70-90% of cases;

3) the duration of the above mentioned winds is from 2-7 days;

4) the highest frequency of these winds occurs in the autumn-winter period and the lowest in summer.

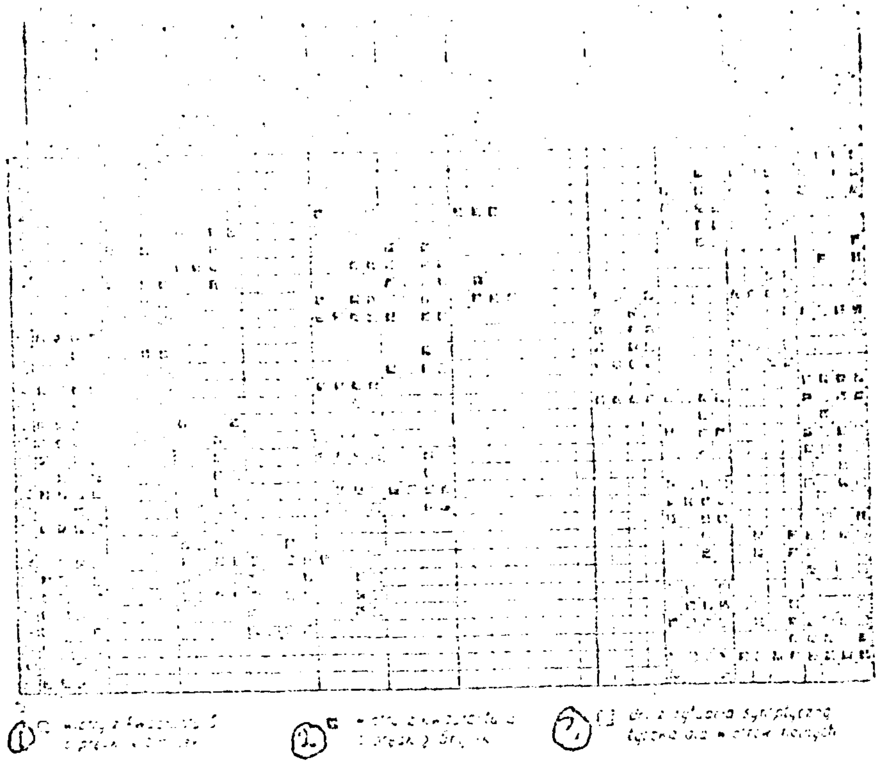

Figure 2

Key: 1--winds from S quadrant with velocities < 5 m/sec
2--winds from S quadrant with velocities ≥ 5 m/sec
3--days with synoptic situations typical for halny winds

The above conclusions justify us to maintain that the ryterski and rymanowski winds do not have the character of local winds caused by thermal gradients between mountain peaks and depths of valleys, but in the majority of cases arise as the result of atmospheric processes resulting from the general baric situation.

Tables 3, 4 and 5 show frequencies of winds with foehn character, and periods of their duration for Kasprowy Wierch, Rymanow and Stary Sacz stations. It follows from these tables that the average number of days with winds of foehn type for Kasprowy Wierch is 72 days, and for Stary Sacz, 73 days (v ≥ 10 m/sec). If, following B. Fikier, we accept the average frequency for the Alps of the appearance of foehn winds to be 30-40 days per year, and the maximal frequency--60 days; for Tirol, 45 days and for Tatras on the average 80 days, according to W. Milata and M. Orlicz, then the above given values for ryterski wind obtained on the basis of observations in two years do not

TABLE 1. [illegible] wind ([illegible] station) and [illegible] on the air temperature accord- [illegible].

Stn.	Yr.		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Nowy Sącz	1951	t_m	-9.2	-9.0	4.0	4.6	12.1	17.2	16.8	17.8	.	8.9	3.0	2.6
		$t_{max.} R$	2.8	4.1	11.3	11.7	16.5	21.3	20.9	24.5	.	17.6	10.9	8.4
		Δ	12.0	13.1	7.3	7.1	4.4	4.1	4.1	6.7	.	8.7	7.9	5.8
	1955	t_m	-3.1	-2.4	-0.4	4.8	11.1	14.6	17.1	.	13.8	8.9	3.2	1.1
		$t_{max.} R$	4.4	6.8	10.7	12.6	18.2	21.5	19.2	.	19.3	14.3	9.3	4.5
		Δ	7.5	9.2	11.1	7.2	6.8	6.9	1.8	.	5.5	5.4	6.1	3.4
Rymanów	1951	t_m	-10.4	-7.9	3.2	3.6	11.5	16.9	15.6	16.3	13.5	7.3	2.6	1.5
		$t_{max.} R$	-1.2	2.2	8.7	11.6	14.1	21.2	17.5	22.7	19.2	13.8	10.8	9.1
		Δ	9.2	10.1	5.5	8.0	2.6	4.3	1.9	6.4	5.7	6.5	8.1	7.6
	1955	t_m	-3.2	-2.6	-0.5	3.6	10.5	14.2	17.1	.	12.6	8.3	2.7	0.2
		$t_{max.} R$	3.3	3.8	12.0	9.9	19.9	21.1	23.4	.	17.5	14.2	10.5	3.6
		Δ	6.5	6.4	12.5	6.3	9.4	6.9	6.3	.	4.9	5.9	7.8	3.4

t_m--average monthly air temperature; t_{max}R--average daily temperature the highest during the occurrence of ryterski or rymanowski wind; $\Delta = t_{max} R - t_m$

TABLE 2. Differences between the average monthly atmospheric pressure and the average daily lowest pressure during the occurrence of ryterski wind (for Nowy Sacz)

yr.		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1951	P_m	79.9	81.5	78.2	80.4	78.3	80.1	76.6	78.4	81.6	82.6	82.9	77.3
	$P_{min.} R$	70.1	70.8	58.3	74.6	69.0	74.6	73.1	71.6	79.5	75.3	71.9	59.5
	Δ	9.8	10.7	19.9	5.8	9.3	5.5	3.5	6.8	2.1	7.3	11.0	17.8
1955	P_m	78.7	70.5	79.5	81.5	80.1	80.2	78.3	.	82.7	80.7	83.7	75.3
	$P_{min.} R$	53.6	62.0	70.9	73.7	74.1	66.7	73.2	.	65.1	70.3	80.2	63.9
	Δ	25.1	8.5	8.6	7.8	6.0	13.5	5.1	.	17.6	10.4	3.5	11.4

P_m--average monthly atmospheric pressure; P_{min}R--average daily atmospheric pressure in the period of occurrence of ryterski wind $\Delta = P_m - P_{min} R$

TABLE 3. [illegible] of occurrence of ryterski wind ([illegible]), [illegible] wind [illegible] and halny wind (Kasprowy Wierch) on the [illegible] in the years 1954-[illegible], and of halny wind (Kasprowy Wierch) in the years 1938-51 [Halny*]

		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Rok
≥ 5 m/sek	Ryt.	10.5	11.0	9.0	4.5	7.0	6.5	3.5	4.0	9.0	11.5	10.5	11.5	102.5
	Rym.	10.5	9.0	5.5	7.0	1.5	6.0	6.5	3.0	5.0	9.0	12.0	12.0	90.0
	Halny	12.0	15.0	16.5	9.0	13.0	12.0	11.0	7.0	12.0	15.0	15.0	14.5	135.0
≥ 10 m/sek	Ryt.	10.5	10.5	7.5	2.0	4.5	2.5	0.0	2.0	4.5	7.5	8.5	12.5	73.0
	Rym.	2.5	2.0	0.0	0.0	1.0	0.5	0.0	0.0	1.0	0.5	2.5	3.5	13.5
	Halny	7.5	9.0	9.5	2.5	4.5	5.0	3.0	1.0	6.5	7.5	8.0	8.5	72.5
	Halny*	7.6	7.9	7.1	8.0	5.5	3.9	2.9	5.0	6.1	7.2	10.1	9.2	81.0

TABLE 4. Average time of duration (in days) of ryterski winds with velocities v ≥ 5 m/sec, on the basis of the results of observations in the years 1954-55

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
5.0	4.5	3.5	2.0	2.5	2.5	1.0	1.5	4.5	4.5	5.5	4.0

TABLE 5. Maximal periods of duration (in days) of ryterski winds with velocities v ≥ 10 m/sec on the basis of the results of observations at Stary Sacz (1954-55), compared with the periods of duration of halny winds at Kasprowy Wierch (1938-51).

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Stary Sacz	5	5	1	2	3	3	1	2	5	5	6	4
Kasprowy Wierch	8	11	5	9	5	6	2	1	6	9	9	7

Figure 3. Synoptic map at 0.00 hrs on May 18, 1955
W = wysoki = high; N = niski = low

deviate from average values and should be considered as reliable. According to S. Leszczycki, winds of foehn type occur on the average 24 days per year at the Tatras foothills in Zakopane. Hence, it seems right to point out large velocities of these winds in the Poprad Valley and that these velocities are close to those observed in the Tatras. We have to assume that in the Rytro locality where the wind reaches maximum velocity, the number of days of southern wind velocity of the order of 10 m/sec and above is higher than in the Tatras. The analysis of wind directions for Rymanow and Stary Sacz (Figure 5) shows their large similarity.

The frequency of appearance of rymanowski winds with velocities 5 m/sec and above agrees with analogical data for the remaining stations, but the frequency of winds with large velocities of the order of 10 m/sec and above is only several days per year and in this connection does not cause any strong weather contrasts.

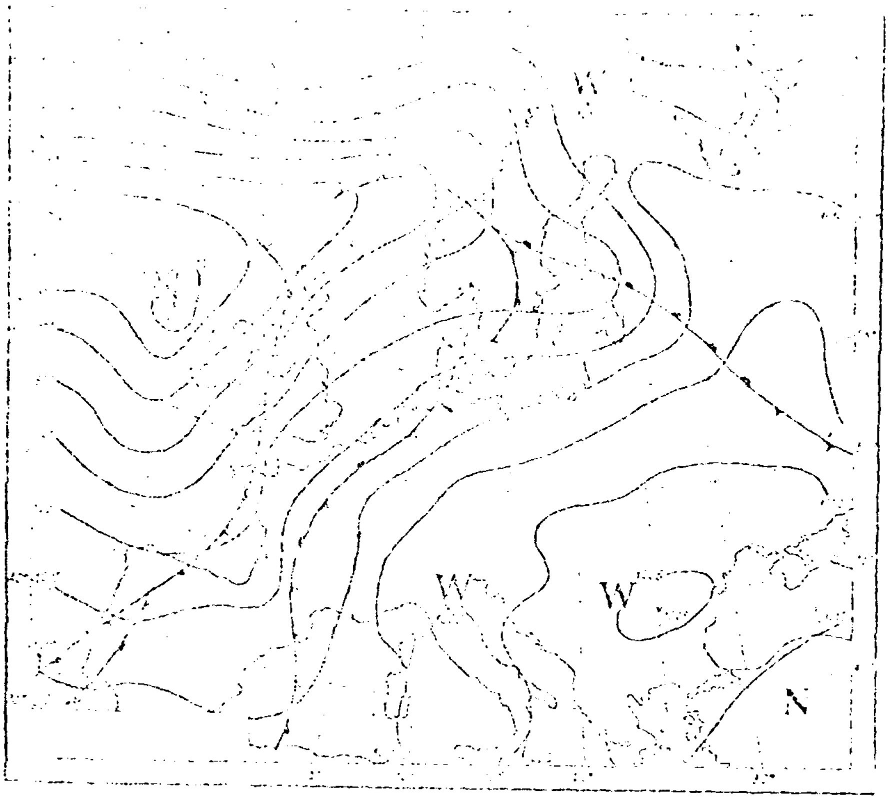

Figure 4. Synoptic map at 0.00 hrs on January 31, 1955

We checked the above obtained results by the field examination in Poprad Valley at the section of Nowy Sacz, Muszyna (of length about 40 km), whereas in the Tabor Valley we limited ourselves to only a local inspection in the Rymanow-Zdroj area. The results of this checking are as follows: Strong periodic southern winds are observed in the Poprad Valley at the section below Piwniczna to Stary Sacz, particularly in the autumn-winter season, and less frequently in summer. These winds cause the warming up. Their strength frequently exceeds 10 m/sec (and not infrequently even 20 m/sec). This strength increases considerably in the vicinity of Rytro town where the width of the valley does not exceed 200 m. In the same locality, according to [illegible] inhabitants, there often occur winds of destructive power which causes loss of roofs, snapping of trees, etc. On the basis of analysis of damages caused by the wind, and of descriptions by local people, one can assume that the power of that wind reaches and sometimes exceeds 3[illegible] m/sec. After the period of occurrence

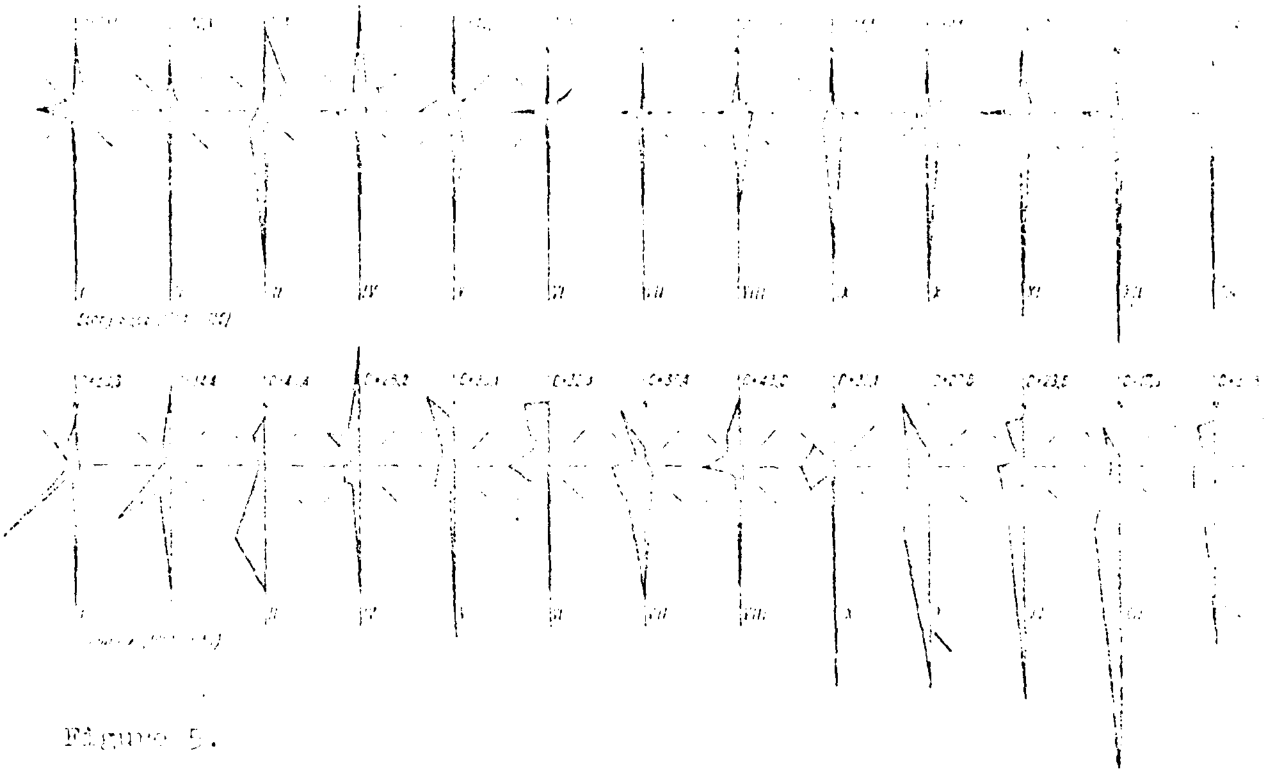

Figure 5.

[illegible], [illegible] period of silence which [illegible] [illegible]. [illegible] the vicinity of [illegible], the [illegible] Valley turns to the [illegible] direction in small regions because of [illegible], hence the phenomenon of the ryterski-type wind [illegible]. The anemometric conditions in the [illegible] River Valley take similar shape although because of relatively small and "shallow" valleys, we do not observe strong winds in this case.

Summarizing the above results, we can state that in valleys perpendicular to the main axis of mountain ridges one periodically observes winds blowing along the axis of the valley. These winds, called ryterski and rymanowski, have all the features of falling winds. They are formed in synoptic situations when centers of low pressure lie NW from the Carpathian chain over the Atlantic and North Sea (particularly over Great Britain) and move toward the east. Then one can observe centers of high pressure SE from the Carpathians, characteristically localized over the Black Sea, the Ukraine and Asia Minor. According to the criterium proposed by W. Milata, the ryterski and rymanowski winds should be considered in the majority of cases as winds of halny-lowland type. The frequency of appearance of ryterski and rymanowski winds is of the same order as the frequency of halny wind in Tatras. In the yearly course one can see the maximum of frequency of the appearance of wind in the autumn-winter period and the minimum in summer.

Manuscript received by the editor on January 29, 1957.

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